

# Specification

## **MODEL: IFR12.8V24AH(4S4P)M5**

Prepared By/Date: 0613/2022

Checked By/Date:

Approved By/Date: 06/20/2022

Customer NO.

Customer Approval

Signature:

Date:

Company Name:

Company Stamp:

Soshine International  
www.soshine.com.cn  
summer@soshine.com.cn

## Amendment Records

Revision	Description	Prepared by	Approved by	Date
A/00	First Publish			04/11/2022
A/01	Charger requirements			06/20/2022

## Special Requirement

Customer should propose their special requirement and communicate with Soshine in advance. If there were some application or operation conditions are different from this specification, Soshine may change the design or product according to customer's special requirement.

No.	Special Requirement	Standard
1		
2		
3		
4		

## 1 Definition

1.1	New Battery	It refers to the status within 7 days from the date of warehousing of the battery.
1.2	Production Date	The manufacture date of the battery. The date of the printed barcode on each associated battery.
1.3	BMS	An effective battery management system that could record the parameters of battery during the service life. The parameters including but not limited to "Voltage", "Current", "Temperature" and so on. This could make sure product application or operation conditions are conformity with our specification.
1.4	Open-Circuit Voltage	The voltage of the battery is not connected to any load and circuit.
1.5	Charge C-Rate	The ratio of the charging current to the battery capacity of the battery.
1.6	Standard Charge	0.2C constant current, 14.2V constant voltage charge to 14.2V, continue charging till current decline to $\leq 0.01C$ .
1.7	Standard Discharge	0.2C constant current discharge to 10.8V.
1.8	Cycle	The battery is charged and discharged once in accordance with the prescribed charging and discharging standards for one cycle.
1.9	Recoverable Capacity	After the battery is stored, the maximum value of 3 measurements is selected according 4.9, 4.5 and 4.12, 4.6 to the capacity measured by the standard charge and discharge conditions.
1.10	Guarantee Period	The general quality assurance period of products. Within one year from the date of manufacture of the product or as agreed by both parties.
1.11	Stage of Charge (SOC)	In the case of no load, the linear relationships of battery charging capacity are measured in Mill ampere hour or watt hour.
1.12	Depth Of Discharge (DOD)	Depth Of Discharge, The upper limit voltage begins to discharge and terminates at the lower limit voltage. Define all discharged electricity as 100%.
1.13	Standard Test Conditions	Unless otherwise specified, all tests should be conducted within one month of delivery under the following conditions: Temperature: $20 \pm 5^{\circ}C$ , Humidity: $60 \pm 15\%$ R.H., Barometric: 86kpa-106kpa
1.14	Temperature of Environment	Temperature of environment which battery stayed.
1.15	Temperature Rise	The increase of battery temperature during charging process or discharge according to the specification.
1.16	Battery Temperature	Temperature that was measured by temperature sensor on the surface of battery.

## 2 Scope

This specification is applies to describe the related battery product in this specification and the battery supplied by Soshine only, as well as product conditions of use and risk warnings.

## 3 Model: IFR12.8V24AH(4S4P)M5

#### 4 Battery Specification

No.	Items	Specifications		Remark
4.1	Type	LiFePO4		Lithium iron phosphate
4.2	Capacity	Nominal Capacity	24Ah	0.2C Standard discharge & new battery status
		Minimum Capacity	23.5Ah	
4.3	Voltage	Nominal Voltage	12.8V	Means operation voltage
4.4		Operation Voltage	10.8~14.2V	
4.5		Absolute Charging Voltage	14.2 ±0.03V	By standard charge method, 3.55V max for unit cell
4.6		Discharge Cut-off Voltage	10.8V	2.7V for unit cell
4.7		Delivery Voltage	12.8~13.2V	Within 10 days from factory
4.8	Standard Charging Method	0.2C constant current, 14.2V constant voltage charge to 14.2V, continue charging till current decline to ≤0.01C		
4.9	Charge Current	0.2C(Standard)	4.8A	Standard charge, charge time about 7.5h(Ref)
4.10		0.5C	12A	Rapid charge, charge time about: 3h(Ref)
4.11		0.5C(Maximum)	12A	For continuous charging mode. Ambient temperature 25°C
4.12	Discharge Current	0.2C(Standard)	4.8A	constant current discharge to 10.8V
4.13		0.5C	12A	For continuous discharge mode. Ambient temperature 25°C
4.14		2C(Maximum)	24A	The surface temperature of the cells ≤60°C
4.15	Impedance	Battery Internal	<60mΩ	Internal resistance measured at AC 1KHz new battery after 50% charge new battery
4.16	Operation Temperature and Relative Humidity Range	Absolute Charge	0~45°C 60±25%R.H.	Battery Surface Temperature Charge at a very low temperature such as below 0°C, will be get a lower capacity and reduce cycle life of the battery. <b>Beyond the temperature range of charge and discharge, the battery must stop working.</b>
4.17		Absolute Discharge	-20~60°C 60±25%R.H.	
4.18		Standard Charging Temperature	25±2°C	
4.19		Standard Discharging Temperature	25±2°C	
4.20	Storage Temperature for a Long Time	-20~25°C 60±25% R.H.		<b>Do not store for more than a year. It must be charged once in storage for half a year.</b>
4.21	Self-discharge Rate Per Month	≤3.5%		New battery after stored more than 3 months.
4.22	Shipment Capacity	30% SOC (≥7.2Ah)		
4.23	Weight	About 2.9±0.3kg		
4.24	Cycle	1000 times		80% D.O.D.
4.25	Output Terminals	M5		
4.26	Maximum Number of Concatenations	Four in series		The dropout voltage between batteries ≤0.1V

## 5 Battery Performance Test Criteria

### 5.1 Appearance inspection by visual

There shall be no such defect as rust, leakage, which may adversely affect commercial value of battery.

### 5.2 Environmental test condition

Unless otherwise specified, all test stated in this product specification were conducted at below test conditions:

Temperature: 20°C~25°C, Relative Humidity: 60%±25% R.H., Barometric: 86kpa-106kpa

### 5.3 Battery electrical characteristics

No.	Items	Test Method and Condition	Criteria	
5.3.1	Rated Capacity at 0.2C(Min.)	After standard charge, the capacity shall be measured on 0.2C discharge till the voltage discharge to 10.8V.	≥24Ah	≥100%
	Rated Capacity at 0.5C(Min.)	After standard charge, the capacity shall be measured on 0.5C discharge till the voltage discharge to 10.8V.	≥23.5Ah	≥98%
5.3.2	Cycle Life	Charging and discharging battery as below conditions: 80% D.O.D. Continuous charge and discharge for 1000 cycles.	≥80% of initial capacity	
5.3.3	Capacity Retention	The battery to be charged in accordance with standard charge condition at 20~25°C, then store the battery at an ambient temperature 20~25°C for 28 days. Measure the capacity after 30 days with 1C at 20~25°C as retention capacity.	Retention capacity ≥85%	
5.3.4	Temperature Dependence of Discharge Capacity	Battery shall be charged per 5.3.1 and discharged @ 0.2 C5A to 10.8V. Except to be discharged at temperatures per Table 1. Battery shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature. The capacity of a battery at each temperature shall be compared to the capacity achieved at 23°C and the percentage shall be calculated.	Each battery shall meet or exceed the requirements of Table 1	

Table 1

Discharge Temperature	-20°C	-10°C	0°C	23°C	60°C
Discharge Capacity (0.2 C5A)	40%	50%	80%	100%	95%

#### 5.4 Mechanical characteristics

No.	Items	Test Method and Condition	Criteria
5.4.1	Vibration Test	After standard charging, fixed the battery to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, the excursion of the vibration is 1.6mm. The battery shall be vibrated for 30 minutes per axis of XYZ axes.	No fire No smoke No explosion
5.4.2	Altitude Simulation	Battery shall be stored at a pressure of 11.6kPa or less for at least six hours at ambient temperature (20±5°C).	No fire No smoke No explosion
5.4.3	High Temperature and High Humidity Test	Keep battery under conditions 40°C ± 2°C Temperature & 90%-95% R.H. for 2hours.	No fire No smoke No explosion

#### 6 Safety Performance

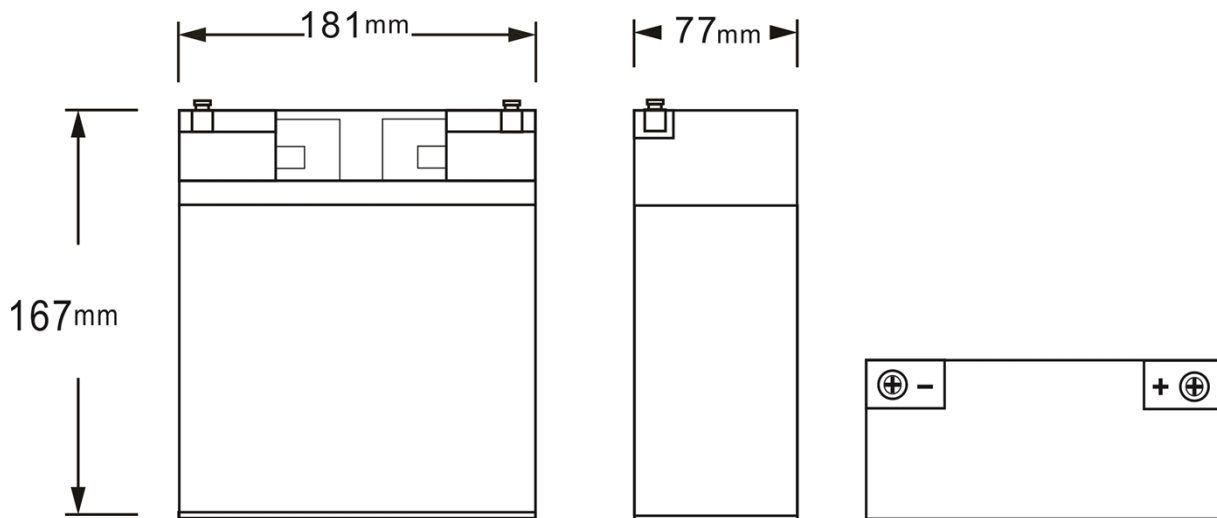
No.	Items	Test Method and Condition	Criteria
6.1	Thermal Exposure Test	Each fully charged battery, stabilized at room temperature, is placed in a circulating air-convection oven. The oven temperature is raised at a rate of 5 °C/min ± 2°C/min to a temperature of 130°C ± 2°C. The battery remains at this temperature for 10 min before the test is discontinued.	No explosion, No fire.
6.2	Short Test (20°C)	The fully charged battery is to be short-circuited by connecting the positive and negative terminals of the battery with resistance load not exceed 100mΩ. Tests are to be conducted at room temperature 20~25°C.	No explosion, No fire. The battery surface temperature does not exceed 150°C.
6.3	Short Test	The fully charged battery is to be short-circuited by connecting the positive and negative terminals of the battery with resistance load not exceed 100mΩ. Tests are to be conducted at room temperature about 60~65°C.	No explosion, No fire. The battery surface temperature does not exceed 150°C.
6.4	Forced Discharge Test	A discharged battery is subjected to a reverse charge at 0.5C for 150 min.	No explosion, No fire.
6.5	Over Charge Test	After standard charge, continue to charge with a constant voltage 20V per battery, holding 8h.	No explosion, No fire.

## 7 BMS Specification

No.	Items	Specifications	
7.1	Current	Operating current	$\leq 24\text{A}$
7.2	Temperature	Operating temperature	$-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$
7.3	Self-consumption	Operating state	$\leq 100\mu\text{A}$
7.4	Internal resistance	MOSFET	$\leq 30\text{m}\Omega$
7.5	Overcharge protection	Protective voltage	$3.90 \pm 0.05\text{V}$
7.6		Restore voltage	$3.60 \pm 0.1\text{V}$
7.7		Overcharge protection delay	$0.5\text{S} \sim 2\text{S}$
7.8	Over-discharge protection	Protective voltage	$2.0 \pm 0.1\text{V}$
7.9		Restore voltage	$2.70 \pm 0.1\text{V}$
7.10		Over discharge protection delay	$10 \sim 200\text{mS}$
7.11		Over current protection	$150 \pm 30\text{A}$
7.12	Short circuit protection	Protection delay	$200 \sim 800\mu\text{s}$
7.13		Recovery conditions	Cut off the load
7.14	Temperature protection	Charging temperature protection (battery)	$75 \pm 5^{\circ}\text{C}$
7.15		Discharge temperature protection (battery)	$75 \pm 5^{\circ}\text{C}$
7.16	Charge equalizer	Start-up voltage	$3.55 \pm 0.05\text{V}$
7.17		Equalize the current	$65 \pm 5\text{mA}$

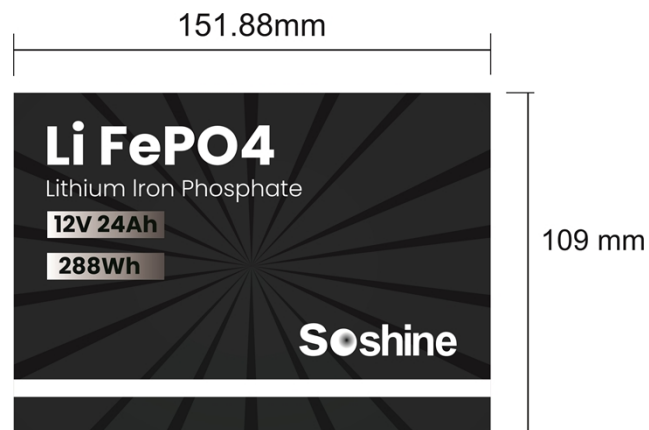
## 8 Battery Initial Dimensions and Label

### 8.1 Dimensions



No.	Item	Unit: mm
1	Battery length	L $181 \pm 0.2$
2	Battery width	W $167 \pm 0.2$
3	Battery height	H $77 \pm 0.2$

### 8.2 Battery label





## 9 Considerations for Different Charging Methods

Battery Surface Temperature	Standard Charge	Fast Charge	Fierce charge
<0°C	Prohibited	Prohibited	Prohibited
>45°C	Prohibited	Prohibited	Prohibited
0~10°C	0.2C	0.5C	Prohibited
10~20°C	0.5C	0.5C	Prohibited
20~45°C	0.5C	Prohibited	Prohibited

## 10 Battery Replacement

Battery life is limited. Customers should set up an effective tracking system to detect and record the internal resistance of the battery. The measurement methods and calculation methods of internal resistance require customers and Soshine to discuss and agree with both parties. When the battery internal resistance is more than 250% of the initial resistance, they should stop using the battery. Any violation of the requirements shall be exempted from Soshine's quality guarantee responsibility which based on product sales contract and this specification.

## 11 Application Condition

Customers should use the battery according to the following correct conditions of use, customer should apply BMS to monitor, manage and protect each battery.

### 11.1 Authorization

Without authorization, the customer shall not modify or change the design and framework of the battery management system, to make sure not to affect the performance of the battery.

### 11.2 Management files

Customer shall build the battery management files. The customer shall keep the monitoring data of the complete battery operation as a reference for product quality responsibility.

The Soshine does not undertake the product quality assurance responsibility without the inspection data of the complete battery system.

### 11.3 Management system requirements

The battery management system needs to meet the following basic requirements:

No.	Parameter	Specification	Protection Action
11.3.1	Absolute Charge	14.2V	Stop charging when the voltage reaches 14.2V
11.3.2	Absolute Discharge	10.8V (Min.)	Stop discharging when the battery voltage reaches 10.8V, Minimize the current
11.3.3	Charge mode	CC/CV	Constant current charging to 14.2V, constant voltage charging to 14.2V. Cutoff current 0.01C(240mA)
11.3.4	Short-circuit Protection	Disconnect	When a short circuit occurs, the battery is disconnected from the over current
11.3.5	Over current Protection	According to 4.11, and 4.14	the battery management system controls the discharge current to meet the specifications
11.3.6	Overheat Protection	According to 4.16 and 4.17	The charge/discharge is terminated when the temperature exceeds the specification of this specification
11.3.7	Charging Time Protection	Within 8 hours	Stop charging when charging time is over 8 hours

NOTES: As for above No. 11.3.1, 11.3.2, 11.3.4, 11.3.6 are warning clauses, the customer please note: when the battery reaches any of these describe indicators and parameters, it means that the battery has already beyond the conditions of use, the customer should be in accordance with the "protection" and other relevant provisions this specification of battery protection measures, at the same time, Soshine statement on the using state of the battery does not undertake any guarantee responsibility for the quality.

#### 11.4 Charge

Charging current: The maximum charging current specified in the specification cannot be exceeded.

Charging voltage: Not exceed the highest limit voltage specified in the specification.

Charging temperature: The charging temperature of the battery must be performed in accordance with the temperature range of the specification.

Charging method: Constant current and then constant voltage charging.

#### 11.5 Discharge current

The battery discharge current cannot exceed the maximum discharge current specified in the specification. Excessive current discharge will cause the battery to heat up and reduce its capacity.

#### 11.6 Over-discharge

The battery may be permanently damaged when the battery voltage is less than 6V, and the product quality assurance of Soshine will be invalid. According to 11.1.3.2 this specification, the internal energy consumption of the system should be reduced to minimum when the discharge cut-off voltage is below 10.8V, and the storage time is prolonged before recharging. The customer needs to train the user to recharge the battery in the shortest time to prevent the battery from over-discharge state.

#### 11.7 Battery storage

If the battery is expected to be stored for more than 30 days, the SOC should be adjusted to about 30%. If the battery is expected to be stored for more than 180days, the SOC should be adjusted to about 80% and the battery to be charged and discharged at least once in the whole SOC range ( 10.8~14.2V) for every 90 days .

### 11.8 Charge at low temperatures

The battery should avoid charging (including standard charging, quick charging, emergency charging) in the low-temperature conditions which is prohibited in this specification, otherwise, unexpected capacity reduction may occur. The battery management system should be controlled according to the minimum charge and regenerative charging temperature. It is forbidden to charge when temperature is lower than the temperature conditions specified in this specification. Otherwise, Soshine shall not be liable for quality assurance

### 11.9 Battery heat diffusion

In the design of the electric box, the heat diffusion of the battery should be fully considered. Soshine shall not be responsible for the quality assurance due to the overheating of the battery or battery caused by the design of the electric box.

### 11.10 Waterproof and dustproof

The waterproof and dustproof problem should be fully considered in the electrical box design, and the electric box must meet the waterproof and dust-proof grade stipulated by the relevant national standards. Soshine is not responsible for quality assurance due to the damage caused by the waterproof and dustproof problem (such as corrosion, rust, etc.).

## 12 Charger Requirements

### 12.1 Special charger for LiFePO4 battery

It is recommended to use a special charger for LiFePO4, constant current and constant voltage charging (fully charged cut-off voltage 14.2V), with short circuit protection, overcharge protection, reverse connection protection, and anti-backfill function. Charging current 12A (max).

### 12.2 Solar panel intelligent charge and discharge controller

Select LiFePO4 charger mode.

Constant current and constant voltage charging (fully charged cut-off voltage 14.2V), with short circuit protection, overcharge protection, reverse connection protection, and anti-backfill function.

Charging current 12A (max)

### 12.3 Lead-acid battery charger

It is recommended to use three-stage charger with overcharge protection, and short-circuit protection.

Voltage range: charge cut-off voltage 13.5~4.6V, float voltage 13.7~3.8V, over discharge voltage 10.8~11V.

Charging current 12A (max)

Lead-acid chargers that meet the above requirements can be used, but the battery may be overcharged, and the long-term use will shorten the life of some batteries or not fully charged, and the full capacity will be reduced by about 5% compared to the normal capacity.

### 13 Storage and Cycling Performance

No.	Parameter	Specification	Conditions
13.1	Recoverable Capacity (Short time)	≥23.28Ah	New battery is charged to 50% SOC, then stored at 25°C for 28 days. Test capacity according to the standard charge and discharge conditions listed in Sections 4.9, 4.5 and 4.12, 4.6 of this specification.
13.2	Recoverable Capacity (Long time)	≥22.8Ah	New battery is charged to 50% SOC, then stored at 25°C for 180 days. Test capacity according to the standard charge and discharge conditions listed in Sections 4.9, 4.5 and 4.12, 4.6 of this specification.
13.3	Absolute Storage Temperature	-20°C ~60°C	
13.4	Capacity After Cycle	≥19.2Ah (1000 times cycle)	New Battery, cycled according to the standard charge/discharge 80% D.O.D.

## 14 Period of Warranty

The period of warranty is one year from the date of shipment. Guarantees to give a replacement in case of batteries with defects proven due to manufacturing process instead of the customer abuse and misuse.

## 15 Storage of the Batteries

The batteries should be stored at room temperature, charged to about 30% to 80% of capacity.

We recommend that batteries be charged about once per half a year to prevent over discharge.

## 16 Battery Performance Attenuation

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

## 17 Note

Any other items which are not covered in this specification shall be agreed by both parties.

## 18 CAUTIONS IN USE

To ensure proper use of the battery please read the manual carefully before using it.

### Handling

- When charging and discharging, do not reverse the battery connection. The positive pole must correspond to the positive pole, and the negative pole must correspond to the negative pole
- Do not expose to, dispose of the battery in fire.
- Do not put the battery in a charger or equipment with wrong terminals connected.
- Avoid shorting the battery.
- Avoid excessive physical shock or vibration.
- Do not disassemble or deform the battery.
- Do not immerse in water.
- Do not use the battery mixed with other different make, type, or model batteries.
- Keep out of the reach of children.
- Don't transport and store the battery together with metal objects such as necklaces, hairpins.
- Don't pierce the battery with a nail or other sharp object.

### Charge and discharge

- Battery must be charged in appropriate charger only.
- Never use a modified or damaged charger.
- Do not leave battery in charger over 24 hours.

### Storage

- Store the battery in a cool, dry and well-ventilated area.

### Disposal

- **If the battery beyond the useful-life, please fully discharged, sticks the battery with insulating tape, then put the battery to the specialized recycle bin.**
- Regulations vary for different countries. Dispose of in accordance with local regulations.